VIII

WATER RESOURCES

Defining Water Resources in the Flagstaff Region

In the Flagstaff region, we rely on surface water, groundwater, and reclaimed water to serve our residential, commercial, industrial, recreational, and agricultural needs. We plan for water resources, an integral part of which is conservation planning, with the intent to sustain our water supplies and quality for future generations.

Where Does Our Water Come From?

As part of this plan, a comprehensive inventory of water resources in the Flagstaff region was conducted, and these were mapped on the *Natural Environment* map. [INSERT MAP]

SURFACE WATER

The city has two primary surface water supplies, the Inner Basin and Upper Lake Mary, which are significant sources of renewable water. Both of these supplies play an important role in the city's water development history dating back to the 1890s and 1940s, respectively. However, these supplies are often subject to the impacts of drought, and have been unreliable at times in the past. In 2011, these renewable surface water sources made up 33 percent (3,416 acre-feet) of the City of Flagstaff's total water deliveries to its customers. None of the unincorporated areas within the *Flagstaff Regional Plan* boundary rely on surface water for domestic supply.

GROUNDWATER

Due to historical impacts of drought, the City of Flagstaff searched for a more reliable water supply in the 1950s and started developing wells. Over the past 60 years, the city has increasingly relied upon groundwater as its primary water supply. While this supply has been very reliable over time, it is extremely expensive due to the great depths at which the regional aquifer exists on the Coconino Plateau, and some well fields have experienced significant water level declines over the last 25 years. In 2011, groundwater made up 46 percent (4,880 acre-feet) of the City's total water deliveries to its customers.

Photo at left by: Callie Walters

GUIDING PRINCIPLES

Sustainability matters. Environmental, economic, cultural, and social sustainability ensure that present actions are the basis for future health and prosperity.

The environment matters. Natural environmental health is inherent to individual and community health, and healthy ecosystems should be nurtured.

Place matters. Regional growth should occur in harmony with the community's historical character, unique cultural resources, and natural environment.

Cooperation matters. Regional partnerships create a strong community, protect the environment, and achieve our common goals.

Water resources are integral to the future of the greater Flagstaff region, for both humans and the environment. Developing a sustainable water budget includes assessing the needs of current and future residents and businesses as well as environmental needs.

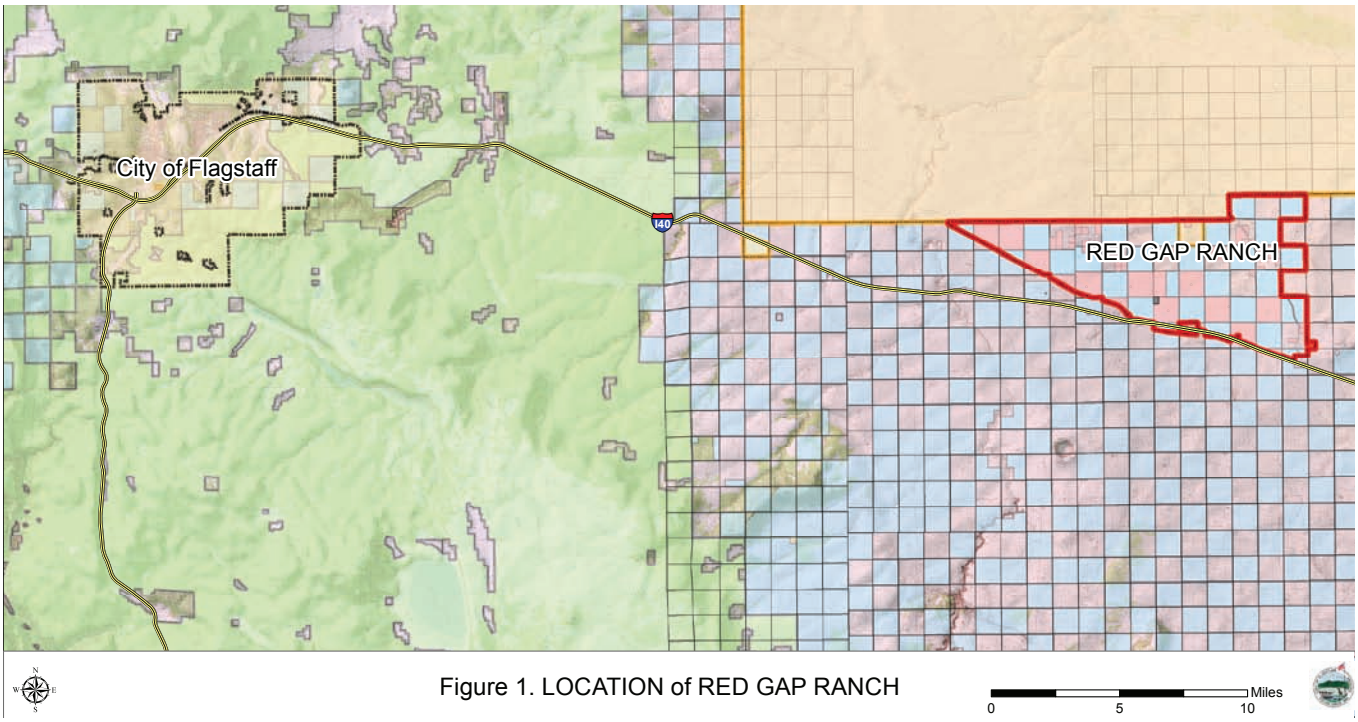


Figure 1. LOCATION of RED GAP RANCH

Helpful Terms

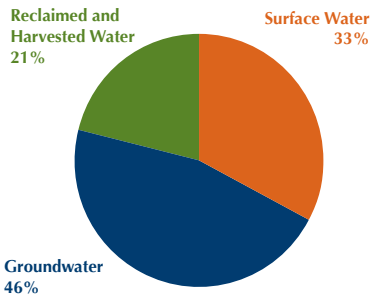
"Acre-foot" - One acre-foot of water serves about four homes in Flagstaff for a year

The wells providing service to the unincorporated county areas rely primarily on the same regional aquifer (the C Aquifer). Others, particularly individual residential wells, draw from shallow, perched aquifers, which are not considered reliable for municipal supply.

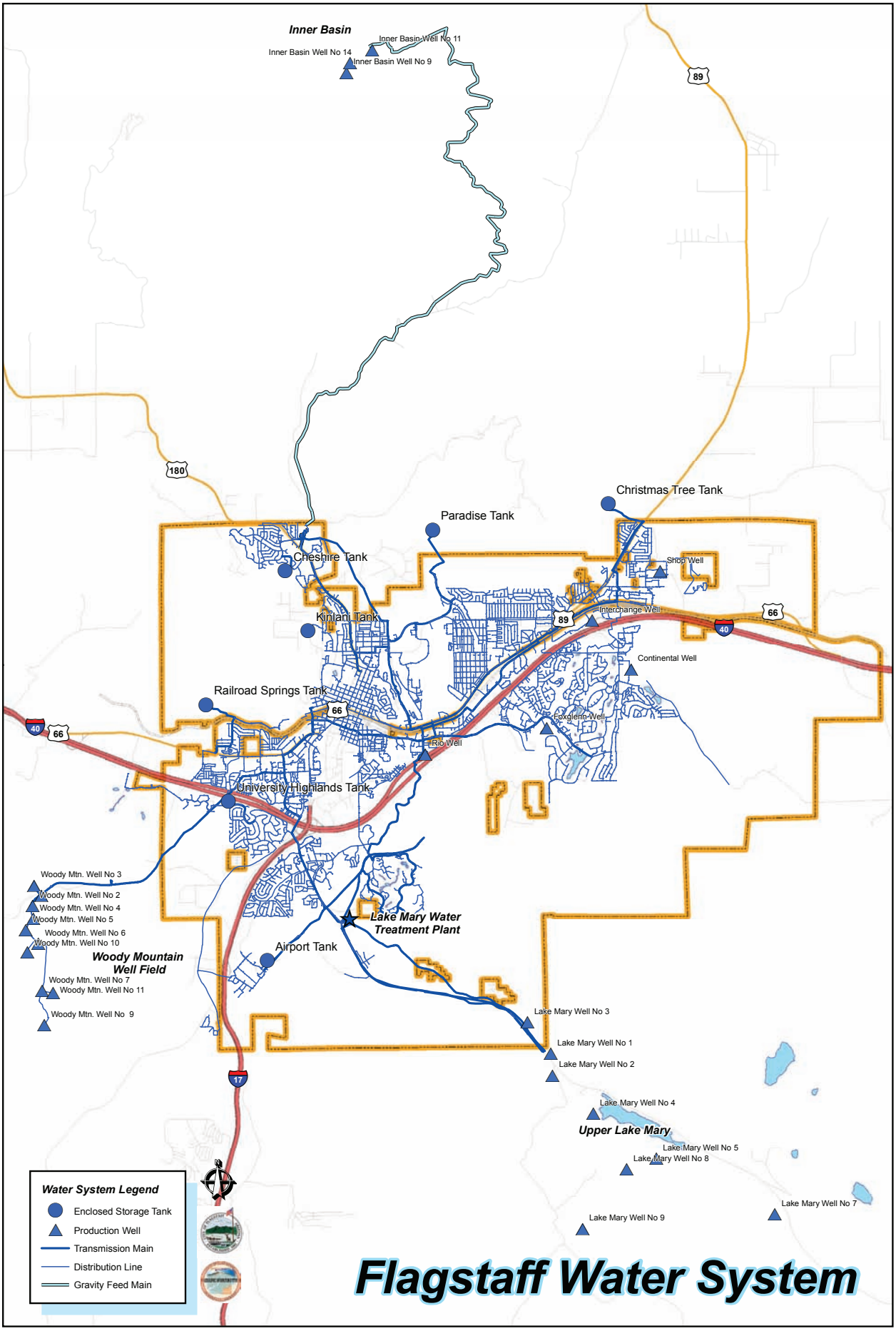
RECLAIMED AND HARVESTED WATER

The City of Flagstaff began treating its wastewater in the mid-1980s to a quality sufficient to reuse or recycle. This "reclaimed water" was first delivered directly to golf courses for irrigation. The unused remaining treated reclaimed water was then discharged into the Rio de Flag, thereby recharging the groundwater aquifer. In the mid-1990s the City constructed its second water reclamation facility and ramped up its water reuse program; it now directly serves more than 60 customers. Additionally, the City has recharged nearly 97,000 acre-feet back to the aquifer via the Rio de Flag since the mid-1980s. In 2011, directly delivered reclaimed water made up 21 percent (2,212 acre-feet) of the City's total water deliveries while recharging approximately 3,962 acre-feet via discharge into the Rio de Flag.

City of Flagstaff
Municipal Water Supply



Most of the unincorporated areas of the county rely on individual septic systems rather than community wastewater treatment, and thus reclaimed water is not widely available. Nonetheless, over the past 20 years, major developments have been required to incorporate reclaimed systems into their design when a community wastewater system is developed. There are two golf course communities outside the city limits, and both were required to incorporate reuse for watering. However, treated wastewater is not generated in sufficient amounts to rely solely on reclaimed water for this purpose.


Inner Basin
Inner Basin Well No 14
Inner Basin Well No 11
Inner Basin Well No 9
89
180
Christmas Tree Tank
Paradise Tank
Cheshire Tank
Shop Well
Kinlani Tank
Interchange Well
89
66
40
Continental Well
Railroad Springs Tank
66
40
66
Foxglenn Well
Rio Well
University Highlands Tank
Woody Mtn. Well No 3
Woody Mtn. Well No 2
Woody Mtn. Well No 4
Woody Mtn. Well No 5
Woody Mtn. Well No 6
Woody Mtn. Well No 10
Woody Mountain Well Field
Woody Mtn. Well No 7
Woody Mtn. Well No 11
Woody Mtn. Well No 9
Lake Mary Water Treatment Plant
Airport Tank
17
Lake Mary Well No 3
Lake Mary Well No 1
Lake Mary Well No 2
Lake Mary Well No 4
Upper Lake Mary
Lake Mary Well No 5
Lake Mary Well No 8
Lake Mary Well No 7
Lake Mary Well No 9
Water System Legend
Enclosed Storage Tank
Production Well
Transmission Main
Distribution Line
Gravity Feed Main
Flagstaff Water System

Goal WR.1. Maintain a sustainable water budget incorporating regional hydrology, ecosystem needs, and social and economic well-being.

POLICY WR.1.1. Participate in and support regional processes to develop a sustainable water budget.

POLICY WR.1.2. Seek regional opportunities to partner with resource land managers and adjacent landowners to improve water yield and hydrologic processes.

STRATEGIES - Continue efforts of cooperative forest health management, such as the Four Forest Restoration Initiative (4FRI).

Goal WR.2. Manage a coordinated system of water, wastewater, and reclaimed water utility service facilities and resources at the city level and identify funding to pay for new resources.

POLICY WR.2.1. Develop and adopt an integrated water master plan that addresses water resources, water production and its distribution, wastewater collection and its treatment, and reclaimed water treatment and its distribution.

POLICY WR.2.2. Maintain and develop facilities to provide reliable, safe, and cost-effective water, wastewater, and reclaimed water services.

Photo by: XXXXXXXXX

STORMWATER AND WATERSHED MANAGEMENT

Photo credit: City of Flagstaff Stormwater Division

The City of Flagstaff manages stormwater as part of an overall healthy watershed management strategy to address the following:

- Urban flooding and runoff quantity
- Stormwater quality
- Low-impact development including water harvesting strategies
- Watershed corridor preservation

For over 50 years, increases to impervious areas from development have resulted in a loss of natural absorption into watershed storage features (i.e., streams and aquifers). Additionally, it has led to significant increases in volume, velocity, and peak flows to adjacent and downstream property and contributed to water quality degradation as a result of contaminants often found in stormwater runoff. Conventional storm drain systems typically include detention basins designed to reduce peak flows during storm events. However, many previous designs do not address volume increases, stormwater quality, or groundwater recharge.

As of 2009, the City has guided the community in using low-impact development (LID) techniques in addition to conventional stormwater systems. LID is an innovative and logical approach to managing stormwater with a basic principle modeled after natural watershed characteristics. LID systems manage rainfall runoff at the source using decentralized small-scale controls uniformly distributed throughout the project area that allow for effective capture, filtration, storage, and infiltration. Conventional storm drain systems in conjunction with LID are helping to address flooding, while additional benefits from LID include improved stormwwater quality, volume decreases, increased groundwater recharge, enhanced open space, improved biodiversity, reductions in land disturbance, lessening of soil compaction, and decreases in long-term costly infrastructure (i.e., underground stormwater pipes and conveyance facilities).

In addition to stormwater management, the City is promoting community water conservation through the practice of rainwater harvesting, which involves collecting and using local precipitation close to where it falls for supporting both human and ecosystem needs. The harvested water can be used for landscape maintenance and, when properly treated, it can meet daily water needs (e.g., cooking, drinking, bathing). Flagstaff is located in a high alpine arid region receiving only 22 inches of precipitation a year. Water harvesting provides a sustainable and low-cost solution to addressing water scarcity and increased future water demands. The benefits of water harvesting include less impact on local surface water and groundwater supplies, the avoidance of costly infrastructure, and lower water bills, among others.

In areas of the county without reclaimed systems and for citizens across the region, many residents rely on other means of water

conservation and reuse such as roof-collection rainwater harvesting and gray water systems.

Watercourse preservation and restoration is also a critical and necessary part of stormwater and watershed management, and as such, the City follows a maintenance program that directly supports the long-term health of the Flagstaff watershed.

GOALS AND POLICIES - STORMWATER AND WATERSHED MANAGEMENT

Goal WR.3. Manage watersheds and stormwater to address flooding, water quality, and environmental protection.

POLICY WR.3.1. Preserve and restore natural watercourse corridors. [Need a description from stormwater as to which size/type, etc.]

POLICY WR.3.2. Preserve watercourses using methods that result in a clear legal obligation to preserve corridors in perpetuity.

POLICY WR.3.3. Incorporate pedestrian access, recreational components, trails, and watchable wildlife opportunities into natural watercourses and regional detention facilities.

POLICY WR.3.4. Identify and mitigate downstream impacts as the result of development.

POLICY WR.3.5. Ensure that any necessary stormwater infrastructure improvements are consistent with City of Flagstaff stormwater master plans or studies as adopted by the City.

POLICY WR.3.6. Give preference to regional detention facilities that incorporate natural watershed characteristics in conjunction with smaller LID features, rather than numerous smaller dispersed basins.

POLICY WR.3.7. Implement stormwater and rainwater harvesting techniques to support water conservation strategies by collecting and using local precipitation in the vicinity where it falls to support both human and overall watershed health needs.

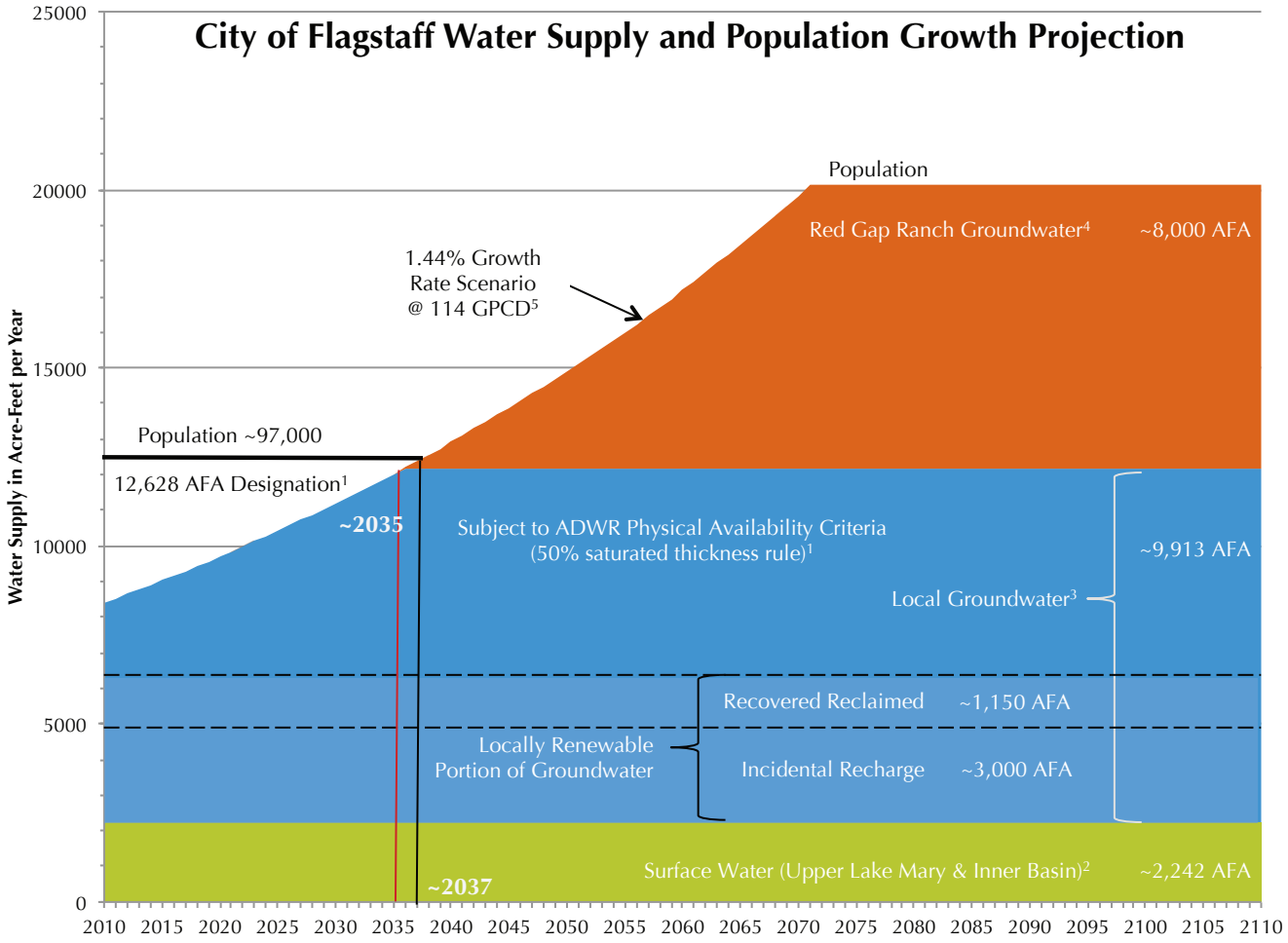
POLICY WR.3.8. Support healthy watershed characteristics through implementation of practices consistent with the City of Flagstaff Low Impact Design Manual.

Photo credit: City of Flagstaff Stormwater Division

Water Demand

The City of Flagstaff is exploring several water supply options to meet future water demands that are outlined in detail in the Water Resources chapter of the *Utilities Integrated Master Plan* (Draft, 2011). These include locally derived water conservation strategies, proposed groundwater supply wells, and advanced wastewater treatment with recharge and recovery. In addition, Flagstaff, along with the U.S. Bureau of Reclamation and in coordination with other regional partners, is looking at the feasibility of importing groundwater from the City's Red Gap Ranch located approximately 35 miles east of Flagstaff.

Both the City and the County participate in the Coconino Plateau Water Advisory Council (CPWAC), which completed the *North Central Arizona Water Supply Appraisal Study* in 2006 for communities across the Coconino Plateau. The results of this study suggest that, based on the assumption of projected water use and current water sources, there would be unmet demands for the region by 2050. The shortfall would be 9,652 acre-feet per year for the Flagstaff Regional Plan area: 8,027 acre-feet for the city, and 1,625 acre-feet for the unincorporated county areas. With this assumption,



and with no further conservation measures in place, 9,652 acre-feet could serve about 39,000 homes over a year's time. A shortfall would exist even after increasing conservation measures by an additional 20 percent. In order to accommodate this unmet water demand, the City of Flagstaff would look to increasing conservation and to continue building its redundancy in water resources.

The Water Resources chapter of the *Utilities Integrated Master Plan* (2011) evaluated different scenarios looking at build-out within the city's incorporated limits. This study evaluated various scenarios of growth rates, water use, and climate variability. The middle scenario projection estimated an unmet demand at build-out (in 2080) of 12,100 acre-feet per year for the city only. The *Utilities Integrated Master Plan* also evaluated potential changes in water use measured as gallons per capita per day (GPCD). The planning effort evaluated decreasing water demand from the current 114 GPCD (2011) to a theoretical 91 total GCPD. Even with this scenario, the city would need additional water supplies by 2040.

Photo by: XXXXXXXXXX

These projections for future demands within the region are based on population estimates and maintaining the current gallons per capita per day water usage. Projection of the shortfall by 2050 did not anticipate any substantial change in type of business or industry the region currently attracts; therefore, the addition of a major water-consuming use would skew the results of this study.

In response to these conclusions, federal funds have been granted to the Bureau of Reclamation under the Rural Water Supply Program, and feasibility-level studies are ongoing for two supply alternatives identified in that regional report. The Bureau of Reclamation is currently investigating the feasibility of the proposed Western Navajo Pipeline that would bring water from Lake Powell to tribes and other stakeholders in northern Arizona in the event of a Navajo-Hopi Indian Water Rights Settlement. The other alternative is the Red Gap Ranch pipeline project.

MANAGING DEMAND

While the City and County have proposed adopting a mandatory water adequacy program related to subdivisions, consideration of this program at the County is on hold pending finalization of the rulemaking process at the state level that to date is not complete. In addition, a substantial amount of development (especially within the county) does not go through the subdivision process.

The City of Flagstaff has reduced potable water consumption by 40 percent through strict water conservation requirements, particularly tied to watering and car washing. Some have expressed concern that these requirements are so strict that they limit urban agriculture, and that special consideration should be given to that use. The County and City both allow gray water and rainwater harvesting systems.

A Conservation Ordinance that applies to all new development, commercial and residential, could be an additional tool to managing the development/water connection.

The County has adopted a voluntary Sustainable Building Program that provides suggestions for accelerated water conservation measures beyond what codes currently require. The County's Landscape Ordinance and the City's Zoning Code use principles of Xeriscape and require appropriate low-water consumptive and native vegetation.

Water and energy is a dependent relationship—electricity is required to produce and deliver potable water, treat wastewater, and deliver reclaimed water. In Flagstaff, projected population growth and increased electrical costs are driving a review of the water-energy nexus. Flagstaff is working to determine the energy costs embedded into every unit of water treated and delivered, which will be used to determine the value, or water footprint, embedded in our economy and network of trade.

GOALS AND POLICIES - WATER DEMAND

Goal WR.4. Satisfy current and future human water demands and the needs of the natural environment through sustainable and renewable water resources and strategic conservation measures.

POLICY WR.4.1. Work together with regional partners to address regional human and environmental water needs.

POLICY WR4.2. Favor low-water consuming businesses and industries over water-intensive uses.

POLICY WR4.3. Integrate sound water conservation and reuse systems into new and updated public facilities.

POLICY WR.4.4. Use reclaimed water and rainwater harvesting wherever appropriate.

POLICY WR.4.5. Encourage private well owners to install meters to understand how much water is used as well as alert property owners to possible leaks.

CITY-SPECIFIC POLICIES

POLICY WR.4.6. Calculate the volume of local water resources it has available and make periodic updates as appropriate.

POLICY WR.4.7. Implement a water management program that creates a linkage between new growth and a minimum 100 year water supply.

POLICY WR.4.8. Identify adequate funding sources to pay for new resources to ensure a long-term renewable water supply.

Goal WR.5. Logically enhance and extend public water, wastewater, and reclaimed water services including their treatment, distribution, and collection systems in both urbanized and newly developed areas of the city to provide an efficient delivery of services.

POLICY WR.5.1. Use the *Regional Plan* as a guide for the Utilities Integrated Master Plan to better plan for the necessary infrastructure sizing and location to accommodate planned growth and resource management.

POLICY WR.5.2. Maintain, at the city level, a financially stable utility to provide reliable, high quality utility services.

POLICY WR.5.3. Locate developments requiring public utility services within the Urban Growth Boundary.

Water Quality

Water quality is an overarching environmental concern that relates to the quality of drinking water supplies; the quality of surface waters necessary to sustain healthy ecosystems including wildlife, aquatic life and plant life; and the contaminants that are generated by development, land uses and other human activity that contribute to the pollution of both surface water and groundwater. Historically, the Flagstaff region has enjoyed generally excellent water quality for surface waters including rivers, streams, creeks, lakes, and reservoirs. The same is true for groundwater, due in large part to the depth to the local aquifers, making them less vulnerable to pollution. However, with growth comes threats. Protecting and improving the quality of the region's surface water and groundwater resources is vital to both human and environmental health.

Goal WR.6. Protect, preserve, and improve the quality of surface water, groundwater, and reclaimed water in the region.

POLICY WR.6.1. Explore the feasibility of additional or alternative treatment technologies for the City of Flagstaff and other surrounding regional wastewater treatment systems, and closely monitor the research on the potential impacts on human health and our regional water supplies.

POLICY WR.6.2. Recognizing the increasing concern about water quality, seek methods to divert contaminants from the waste stream.

POLICY WR.6.3. Implement best management practices to protect, restore, and maintain surface waters and their contributing watersheds.

POLICY WR.6.4. Encourage low-impact development strategies.

POLICY WR.6.5. Ensure that the City and County have water quality data available and accessible to the public.

Regional Water Planning

Photo by:

Addressing water resources on a regional basis is challenging and complex. Although the entire Flagstaff Regional Plan area relies generally on the same resources (groundwater and surface water), the management and delivery of the water involves a number of different systems. The City of Flagstaff is the primary water provider within the region, serving most property within the city's jurisdictional boundary and also to water haulers (commercial and individuals) who transport the water to homes and businesses within the unincorporated areas of the county. Coconino County is not a water provider, but there are a variety of private water systems serving some of the outlying county communities and subdivisions, as well as small wells serving individual homes. As a natural resource, water knows no jurisdictional boundaries; the commodity of water, however, has been relegated to jurisdictions for regulatory and delivery purposes.

The City's *Water Resources Sustainability Study* (Draft, July 2012) and the Water Resources chapter of the *Utilities Integrated Master Plan* (Draft, April 2011) begin to address the idea of a sustainable water supply. While the State of Arizona requires the *Flagstaff Regional Plan* to address the commodity of water to serve human needs, the City of Flagstaff and Coconino County both recognize the need to address the resource in a natural systems sense as well. This chapter addresses water resources available to the region including the regulatory framework for water resources, and the current efforts to address water resource issues through a regional partnership.

As described earlier, the City of Flagstaff and Coconino County are members of the CPWAC, a partnership of 28 entities that was formed under the state's Rural Watershed Initiative to facilitate and implement sound water resource management and conservation strategies on the Coconino Plateau. The CPWAC mission is "To ensure an adequate long-term supply of water is available to meet the current and future reasonable needs while preserving the health of the environment on the Coconino Plateau." Strategic initiatives of the CPWAC include working with the Bureau of Reclamation to project current water use and water sources, pursuing federal authorization for a feasibility study to identify alternatives to meet projected demands, developing a regional water ethic, and identifying a sustainable water budget.

REGULATORY FRAMEWORK

Historically, water has been deemed a resource of the State of Arizona, and authority over groundwater and surface water is currently under the jurisdiction of the Arizona Department of Water Resources (ADWR). ADWR recognizes groundwater, surface water, reclaimed water, and the Colorado River as distinct legal water sources.

Water Management Programs administered by ADWR (the Assured and Adequate Water Supply programs) generally have been developed as consumer protection programs to address growing concerns about Arizona's limited water supplies. The 1980 Groundwater Management Act created Active Management Areas that operate under the Assured Water Supply Program, and have a management goal of "safe yield," which is defined as the long-term balance between groundwater withdrawals and the amount of water naturally and artificially recharged into the aquifers. The Assured Water Supply Program is mandatory, and requires that a 100-year water supply must be demonstrated before a subdivision can be approved by the platting authority, such as a city or county, where the Water Adequacy Program is voluntary. Within either the Assured or Adequate Water Supply programs, a 100-year supply is based upon five criteria. The water must be (1) continuously, (2) legally, and (3) physically available; (4) the water provider must demonstrate the financial capability to construct and maintain treatment and delivery facilities; and (5) the water must be of sufficient water quality to meet state and federal standards. It is ADWR's responsibility to determine whether these criteria have been met.

Although no part of Coconino County is within an Active Management Area (which adhere to the Assured Water Supply rules), the State Legislature created the mandatory Water Adequacy Program in 2007. This program authorized cities, towns, and counties located outside of Active Management Areas to require an adequate water supply determination from ADWR prior to the approval of a new subdivision (i.e., Mandatory Water Adequacy Rules). Just like the Assured Water Supply Program, the Water Adequacy Program does not apply to lot splits or major commercial/industrial developments that are not associated with a subdivision, and such development may proceed without demonstrating that a 100-year water supply exists.

The City of Flagstaff was deemed to have a Designation of Water Adequacy back in 1973, although it was not based on hydrologic information. The City has submitted applications to modify its designation in order to quantify the hydrology. The first of these to be accepted was for Red Gap Ranch, which was accepted by ADWR in 2011.

Many subdivisions in Coconino County have been unable to obtain a Designation of Water Adequacy, primarily due to the great depths of groundwater on the Coconino Plateau. If groundwater levels are projected to decline below 1,200 feet after 100 years of providing water to that subdivision, then the water supply is deemed to be not adequate. Many wells in the County, including the Flagstaff region, are already at levels greater than 1,200 feet, typically over 1,500 to 2,000 feet.

The State of Arizona is giving special consideration to the groundwater aquifers on the Coconino Plateau in this region, however, and has developed hydrologic guidelines that would better accommodate the local hydrology in developing new rules for physical availability.

COUNTY AREAS

County residents who are not part of the City of Flagstaff's water distribution system obtain water in a variety of ways, including public community water systems, owner cooperatives, Domestic Water Improvement Districts, shared wells, individual wells, and hauled water. Coconino County has no regulatory authority over the operation of these systems, and they fall under a variety of agencies for review. The following is a list of the unincorporated areas and their respective water providers that are outside the City of Flagstaff's water service area:

Bellemont: Flagstaff Meadows (Utility Source, LLC) and Bellemont Water Company includes water distribution systems for the subdivision and also for the industrial area; standpipe sales to water haulers are also available in this area (Flagstaff Meadows Subdivision has a 100-year adequacy designation). Camp Navajo has its own water system.

Doney Park, Timberline-Fernwood: Doney Park Water (an owner cooperative) provides water to a majority of area residents and businesses. They also maintain standpipe sales for water haulers. DPW has calculated their service abilities based on existing county zoning.

Fort Valley: Many residents have individual wells. The Majestic View Domestic Water Improvement District serves two subdivisions. Some residents rely on hauled water.

Kachina Village: The Kachina Village Improvement District (KVID) provides water (and wastewater) service to the subdivision. KVID has constructed wetlands for their wastewater system and also sells reclaimed water to neighboring Forest Highlands for use on their golf course.

Mountainaire: Ponderosa Utility is a private water company serving the Mountainaire Subdivision and areas along Old Munds Highway east of I-17 including the Highland Meadows Subdivision.

Flagstaff Ranch: Flagstaff Ranch Water Company serves the commercial and industrial area just west of the City boundary between Route 66 and I-40, and Flagstaff Ranch Golf Club and Westwood Estates located south of I-40.

Forest Highlands: Forest Highlands Water Company serves this private residential golf course community. They also purchase reclaimed water from KVID for use on their golf courses.

Heckethorn: Flagstaff Heckethorn Water Company serves about 44 customers in the Heckethorn area located off of Lake Mary Road.

Mountain Dell: Mountain Dell Water, Inc. serves about 80 residential

customers in a small county island north of Fort Tuthill.

West Village: West Village Water Company serves a mix of residences and businesses and standpipe for sales in a county island area in west Flagstaff north of Route 66.

Forest Dale: A County island off Butler Avenue where residents rely on hauled water.

Pine Del: This County subdivision located southeast of Fort Tuthill is served by the City of Flagstaff water system.